MULTIDISCIPLINARY RESEARCH LABORATORIES: 01

- **Molecular Biology- Dr. Rehan Imad**
- **Cell Culture- Dr. Shumaila Usman**

MULTIDISCIPLINARY RESEARCH LABORATORIES: 02

- **Cell Biology & Histology- Dr. Abdul Hameed**
- **Microbial Genomics- Dr. Ambrina Khatoon**

The Research Laboratories (MDRL 1 & MDRL 2) at Ziauddin University and MDRL3 at Ziauddin hospital provide:

- Cell and molecular biology, genomic and proteomic techniques
- Services include training on all equipments, guidance on experimental design and technical assistance in all equipments operation
- Cell culture facility
- Imaging facility with high resolution microscopy
- Immunohistochemistry facility
- Nucleic acid extraction in Biosafety Level 2 cabinet
- Real Time PCR (MDRL 3)
- Bioinformatics and Computational Biology
- Microbial Genomics Lab
- Pharmacy laboratories
- Virtual lab facility connected to north site pathology & genetic laboratory

Multi-Disciplinary Research Laboratory-1 (MDRL-1)

Molecular Biology Research Unit

Molecular Biology Section in MDRL 1 is well equipped with the following instruments:

1. Agilent AriaMx Real Time PCR
2. Conventional Thermal cycler for PCR
3. Gel electrophoresis unit
4. Analytical balance
5. Refrigerated centrifuge
6. Gel documentation system

7. Multi scan sky spectrophotometer
8. Fridge
9. -80°C Freezer
10. Vortex machine
11. Water bath
12. Heat block

Molecular Biology Research Unit (Facilities)

Following experiments can be performed in the MDRL 1 lab:

- Nucleic acid extraction and quantification
- cDNA synthesis
- Conventional PCR
- Agarose gel electrophoresis
- Real time PCR for gene expression, viral load, allelic discrimination, high resolution melt curve, SNP and mutational analysis
- RFLP analysis
- ELISA studies
- Sample storage facility
- DNA, RNA and protein estimation in various samples.

Cell Culture Research Unit

Following equipment are available in the cell culture facility of MDRL 1.

1. Class II Biohazard Safety Cabinet
2. CO_2 Incubator
3. Inverted Microscope with image capturing facility.
4. Centrifuge
5. Automated Cell Counter
6. Fridge
7. Liquid Nitrogen Tank

With the ability to perform following assays

- Tissue culture
- Revival, sub culturing and cryopreservation of cell lines.
- Primary cell culture
- Isolation, propagation and differentiation of stem cells
- Cytotoxicity assay
- Cell migration and invasion assay
- Immunocytochemistry
- Apoptosis assay
- Cell proliferation/viability assay

Cell Culture Research Unit (Facilities)

Cell Culture and Molecular Biology Laboratory (Research Output)

S. No.	Project Title	Status
1.	*In-vitro* differentiation of human umbilical cord derived mesenchymal stem cells into dopaminergic neuron like cells	completed
2.	*In-vitro* differentiation of Human Amniotic Epithelial Cells (hAECs) into hepatic like cells by using small molecules	completed
3.	Effect of bone dust of on osteogenic differentiation of umbilical cord derived mesenchymal stem cells	completed
4.	Association of plasma prolidase and oxidative stress in polycystic ovary syndrome	Completed
5.	Association of serum 14-3-3η with rheumatoid arthritis	Completed
6.	Salivary levels of basic fibroblast growth factor & resistin associated with potential changes in oral carcinogen habitués	Completed
7.	Expression of tumor necrosis factor receptor superfamily member 4 and its ligand OX40 and 40 ligand in OSCC.	Completed
8	Gene polymorphism of KCNQ1, FTO and JAZF1 in adults with parental history of type-2 diabetes mellitus	Completed
9	Expression of MALAT1 in diabetic patients with or without coronary artery atherosclerosis	Completed
	Exploring potential link between neonatal medicinal exposure & long-term neurobehavioral outcome: a preclinical study on fluoxetine.	completed
10.	Establishment & gene expression analysis of primary fibroblast cell line from normal and oral sub mucous fibrosis specimens	in progress
11.	Establishment & protein characterization of primary oral sub mucous fibrosis cell line	in progress
12.	Comparative effects of mevastatin and its liposomal conjugated nano formulations on HT29 cell line of colorectal carcinoma	in progress
13.	Comparative effects of sesamol and its liposomal formulation in averting the metastasis of colon cancer cell line HT-29	in progress
14.	Expression of CLEC3B and tetranectin as a potential clinical biomarker for early detection of oral squamous cell carcinoma	in progress
15.	Salivary miRNA-18a-5p: a potential diagnostic marker of oral squamous cell carcinoma	in progress

Multi-Disciplinary Research Laboratory-2 (MDRL-2)

Histology and Cell Biology Research Unit

A well-established Histology & Cell Biology lab was established in 2018 at Ziauddin University with the following mentioned equipment:

1. Nikon Ts2R-FL inverted microscope
2. Dissecting Microscope
3. Microtome
4. Fume hood
5. Magnetic stirrer
6. Shaking water bath
7. Water bath
8. Oven
9. Hybridizer

With the capability to perform the following experiments

- Animal dissection
- Tissue fixation
- Tissue processing
- Paraffin embedding
- Thin Tissue sectioning
- Hematoxylin and eosin staining
- Special staining
- Immunohistochemistry/ Immunocytochemistry

Histology and Cell Biology Lab Facilities

Histology and Cell Biology Laboratory (Research Output)

S. No.	Project Title	Status
1	Nephroprotective effect of function foods: A preclinical study on cisplatin induced toxicity in mice	Completed
2	Role of tumor cell intrinsic mTOR signaling and PTEN deletion in expression of PD-L1 in microenvironment of prostate adenocarcinoma.	Completed
3	Evaluation of hepatoprotective activity of N-(2-hydroxyphenyl) acetamide and its gold conjugated nanoparticles on in vivo model of CCl4-induced hepatic damage.	Completed
4	Prevention of LPS-induced acute kidney injury in via Naringin: An in vivo analysis	In progress
5	Evaluation of Glucose-dependent Insulinotropic Mechanism(s) of Apigenin and Diosmetin in Isolated Mice Pancreatic Islets	In progress
6	Modulation of TGF-β1 and associated pulmonary fibrotic changes in diabetic mice model	In progress
7	Effects of Aerobic and Resistance Exercise on Pancreatic β-cell Function and Regeneration Potential in Diabetic Rats model	In progress
8	Evaluation of Pancreatic β-cell Regeneration Potential of Fenugreek Seed Extract and Insulin Secretory mechanism(s) of its Phytoconstituents	In progress
9	In-vivo analysis of preventive mechanism(s) against rhabdomyolysis-induced acute kidney injury using hesperidin via targeted nanoparticle-based drug delivery system	In progress
10	Evaluating the preventive mechanism(s) of vanillin and its lungs targeted nano formulations against LPS-induced liver injury *in vivo*.	In progress
11	Evaluating the protective effect of Hesperidin conjugated nano-formulations against lipopolysaccharide-induced acute lung injury in mice	In progress

Multi-Disciplinary Research Laboratory-3 (MDRL-3)

To foster research activities and to enhance the quality of research projects and publications by incorporating advanced molecular techniques, Diagnostic Molecular Genetics lab in North Campus has now been declared MDRL-3. Different research projects are now undergoing in MDRL. Furthermore, research projects in the current wake of Covid-19 have also been designed that will be run in the MDRL-3 at Ziauddin University North Campus.

Following equipments are available in the MRDL 3 of Ziauddin University

1. Real time thermal cycler
2. Biosafety level 2 cabinet
3. Gel electrophoresis unit
4. Fluorescent microscope
5. Refrigerated centrifuge
6. Gel documentation system

With the capability to perform the following experiments.

- DNA and RNA isolation in biosafety level 2 lab.
- Quantitative PCR with several modifications.
- High resolution melt curve for single nucleotide polymorphism.
- Gel electrophoresis.

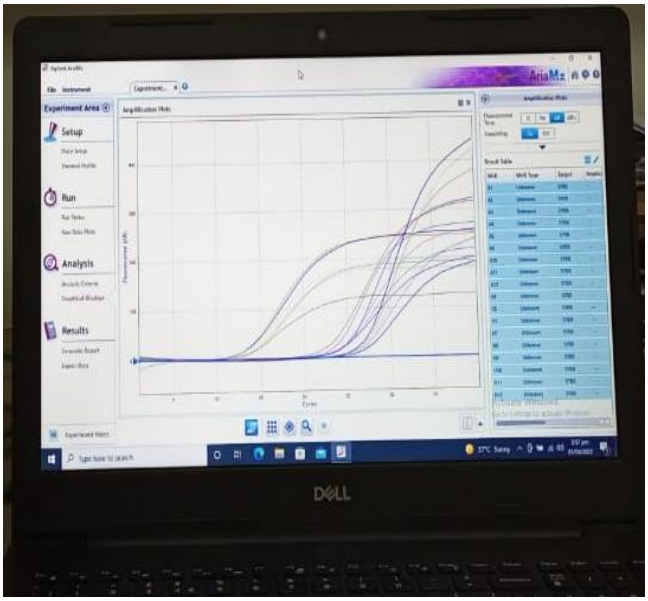
NEW RESEARCH SECTIONS

Real time PCR Lab (MDRL-1)

To cater the increasing need for real time PCR based experiments, a new qPCR section has been introduced in MDRL1 LAB. A new real time PCR Agilent AriaMx has been purchased for research and commercial activities in MDRL 1. This instrument is capable of performing the following assays.

- Gene expression studies
- Gene quantification studies

- Gene polymorphism studies
- Multiplex assays



Bioinformatics Lab (MDRL-2)

In the spirit of the ZU for academic excellence and expansion into new areas of research, a new bioinformatics section has been established in MDRL 2 with the following aims in mind:

- It will fulfill the need for molecular level research and development of highly-qualified manpower for ZU as it will have high configuration storage mandatory for Bioinformatics, which has now become a very important tool for next level investigations.
- It will conduct and contribute to the cutting-edge of modern research in genomics and bioinformatics, as an additional adjunct facility.
- Currently, we launched a high configuration system.
- The analysis taken with this system are of high quality, hence would increase the chances of research article publication in high impact factor international journals.
- The ultimate goal is to enable personalized genomics medicine to become commonplace.

Features and Applications:

- Recently we launched the next generation genome sequencer.

- The high-throughput genome sequencing is being driven by the high demand for sequencing.
- NGS parallelizes the sequencing process, producing thousands or millions of sequences at once. The latest NGS sequencers from 454 sequencing, Solexa (Illumina) and Applied BioSystems (SoLiD) now routinely produce terabytes (TB) of data.
- With additional overheads of reference genome storage/access, and type of analysis to be done, there is a requirement for cost effective, high performance and high throughput clusters and storage to handle these tasks.

The infrastructure of the bioinformatics section is ready, and high configuration computers have been launched and now actively working in execution of research projects.

Microbial Genomics (MDRL-2)

Due to COVID-19 pandemic the situation in scientific world has been changed tremendously and since its burst, 90% of the articles published are related to SARS-CoV-2 research. Microbial Genomics played a key role to deal with such a threatening situation, and strongly believe to make differences in future as well. In this demanding changing era of open science, accessible digital and biological data is the key to fight against challenging infectious diseases. In this regard, we took an initiative to start the active Microbial Genomics research laboratory at MDRL-2 lab, ZU, to equipped ourselves in meeting the challenges in future as the infrastructure and knowledge are far more important than they were in previous decade.

The basic infrastructure of the Microbial Genomic section is ready, for the execution of research projects.

Following equipment are available in the Microbial Genomic facility of MDRL 2.

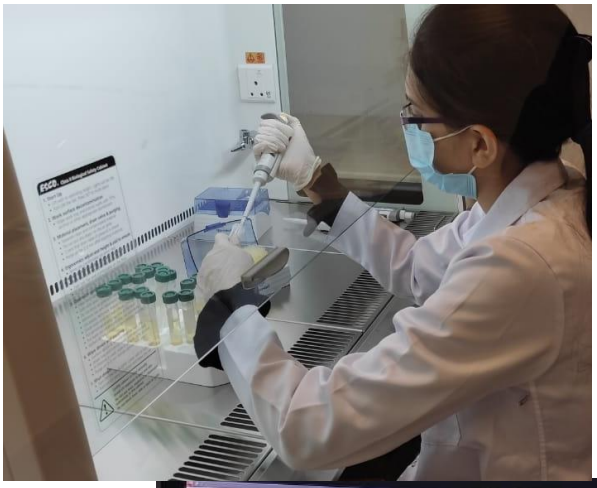
1. Class II Biohazard Safety Cabinet
2. Thermal Shaking Incubator
3. Microscope
4. Centrifuge
5. Cold storage facility
6. Fridge

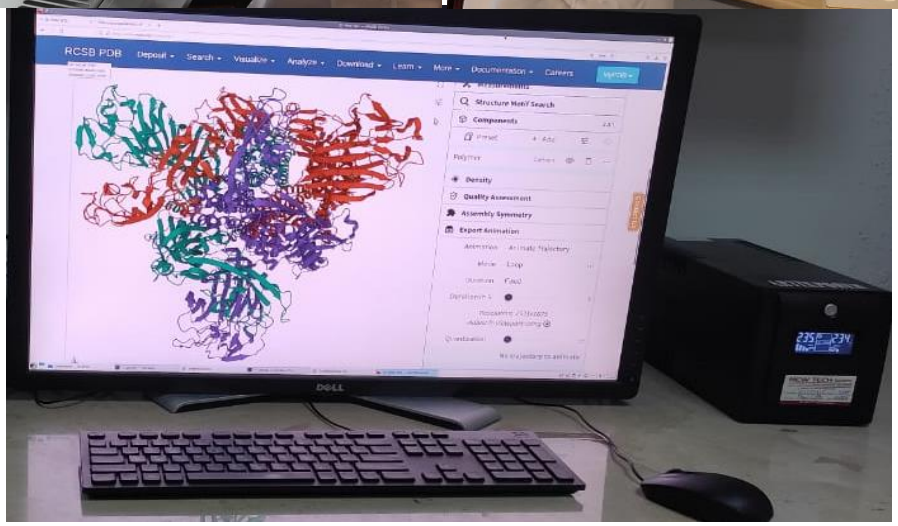
With the ability to perform following assays

- Microbial growth
- Transformation
- Plasmid extraction
- DNA purification

- Cell proliferation/viability assay

Bioinformatics and Microbial Genomics Lab Facilities



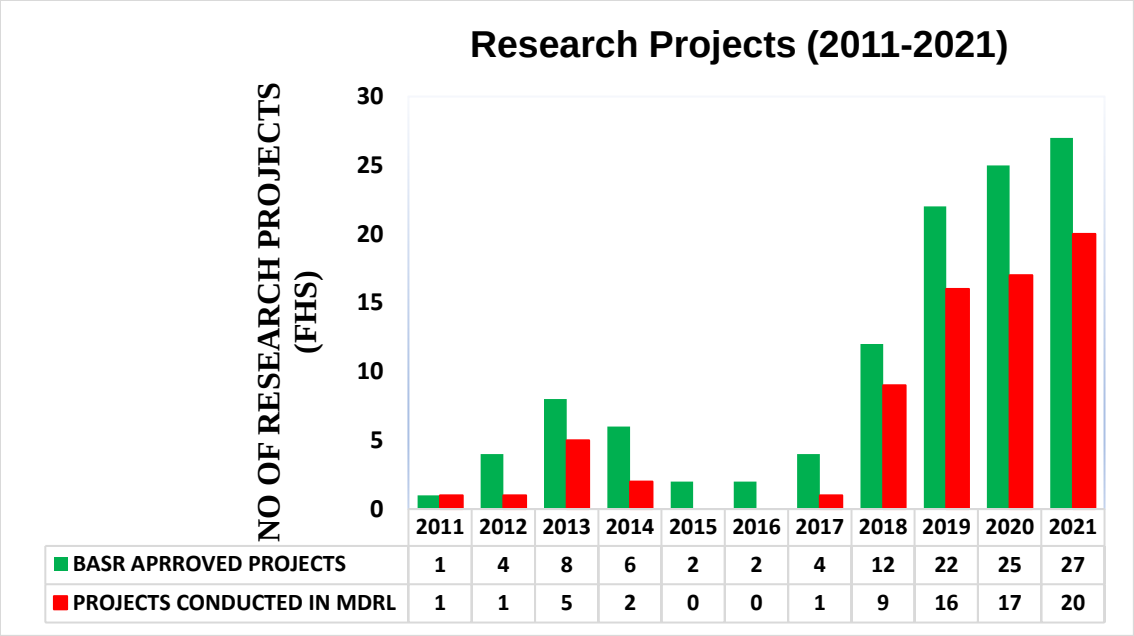


Bioinformatics and Microbial Genomics Lab (Research Output)

S. No.	Project Title	Status
1.	Genome-wide subtractive approach to prioritize a hypothetical protein of XDR *Salmonella typhi* as potential drug target	in progress
2.	Multiplex Real-Time PCR diagnostic kit for simultaneous detection of coinfection of COVID-19, influenza A/B virus and Respiratory Syncytial Virus.	in progress
3.	High-throughput virtual screening of natural compound inhibitors against *Candida auris*	in progress

4.	Comparative antibacterial activity of carvacrol conjugated silver (Ag) & zinc oxide (ZnO) nanoparticles alone & in combination with meropenem against carbapenem resistant Acinetobacter species.	Completed
5.	HLA genotyping of COVID19 patients.	in progress
6.	Variant identification of COVID19 virus.	in progress
7.	Clinicopathological analysis and association of ACE-2, TMPRSS2 gene polymorphism with severity of COVID-19.	Completed
8.	Association of BRAFV600E and KRAS expression with degree of differentiation in colorectal carcinoma.	in progress
9.	Identification of actionable gene variants and mutational landscape of Pakistani TNBC patients.	in progress
10.	Whole transcriptome sequencing of extensively drug resistant *Salmonella typhi* after high-throughput virtual screening of antimicrobial compound.	in progress
11.	Genetic signatures analysis of NAFLD patients using whole exome sequencing.	in progress
12.	Validation of high-risk human papilloma virus with molecular profile of cervical cytopathology.	in progress
13.	Evaluation of the impact of COVID pandemic on antibiotic resistance in Pakistan	In progress
14.	Association of Clinical Parameters with Anatomy of COVID 19 Actionable Genes: ACE2, TMPRSS2, TYK2, LZTFL1 and DPP9	In progress
15.	Association of IFNAR2 gene Variants and Viral Load with the Clinicopathological Parameters Of COVID-19	In progress
16.	Comparison of Matrix Metalloproteinase (MMP-8) Polymorphism and Protein Expression in Oral Sub-mucous Fibrosis (OSF)	In progress
17.	Hepato protective effect of functional food supplement	Completed
18.	Correlation of interferon Alpha levels with severity of covid-19 patients.	Completed
19.	Association of HLA-G polymorphism with HPV related Cervical Cancer	In progress

Summary of Research Progress



Significant rise in the number of projects conducted in MDR labs during the years 2018-21